

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division  <b>INDUSTRIAL HYGIENE GROUP</b> Standard Operating Procedure: Field Procedure	NUMBER <b>IH75140</b>
	REVISION <b>FINAL Rev4</b>
<b>Atmospheric Testing with Integrated Sampling, i.e.</b> <b>Media &amp; Pump Sampling</b> (Active & Passive Sampling with Sorbents / Filters / Impingers)	DATE <b>05/30/06</b>
	PAGE <b>1</b> OF 14

## Contents

- 1.0 Purpose/Scope**
- 2.0 Responsibilities**
- 3.0 Definitions**
- 4.0 Prerequisites**
- 5.0 Precautions**
- 6.0 Procedure**
- 7.0 Implementation and Training**
- 8.0 References**
- 9.0 Attachments**
- 10.0 Documentation**



### **1.0 Purpose & Scope**

This document describes a generic policy to follow for airborne contaminant sampling with a pump connected to a sorbent tube/impinger/or filter or with a passive badge. NIOSH or OSHA sampling and analysis methods must be followed for the particular sampling parameters for each contaminant to be sampled.

The goal of the procedure is to provide a uniform methodology to collect representative samples of chemical vapor, fumes, mists or particulates. Using this method will ensure that variation between various surveyors is minimized and that all pertinent data will be captured at the time of sampling. The use of this procedure is appropriate for OSHA and ACGIH occupational exposure limit (OEL) compliance testing.

Employee exposure assessments for occupational exposure compliance should be made with a personal, breathing zone sample collected on a sorbent/filter/impinger. Area samples (fixed location) using high volume samplers, may be necessary in limited situations for employee exposure assessments to attain the needed limit of quantification to determine OEL compliance. In these instances, the operations must be of short duration (15 to 30 minutes) and involve limited employee movement so that the fixed sample can measure the actual employee exposure.

### **2.0 Responsibilities**

<p align="center"><b>BROOKHAVEN NATIONAL LABORATORY</b> Safety &amp; Health Services Division</p> <p align="center"><b>INDUSTRIAL HYGIENE GROUP</b> Standard Operating Procedure: Field Procedure</p>	<p>NUMBER <b>IH75140</b></p>
	<p>REVISION <b>FINAL Rev4</b></p>
<p align="center"><b>Atmospheric Testing with Integrated Sampling, i.e.</b> <b>Media &amp; Pump Sampling</b> <b>(Active &amp; Passive Sampling with Sorbents / Filters / Impingers)</b></p>	<p>DATE <b>05/30/06</b></p>
	<p>PAGE <b>2 OF 14</b></p>

- 2.1 **Program Administration:** This procedure is administered through the SHSD Industrial Hygiene Group. Members of the SHSD Industrial Hygiene Group and other BNL organizations that provide BNL with field monitoring or other hazard assessment services are required to follow this procedure.
- 2.2 **Industrial Hygiene Professional:** The *Industrial Hygiene Professional* of SHSD and other BNL organizations are to be qualified by their supervision. These individuals will conduct or supervise industrial hygiene hazard assessments and personal exposure monitoring using this procedure. These *IH Professionals* are responsible for:
- Interpreting, reporting, and documenting personal exposure monitoring in accordance with the requirements of this procedure, other appropriate SOPs, and generally accepted professional standards and practices.
  - Ensuring a quality report is prepared that documents the exposure, evaluates the relevance to exposure standards, and recommends protective and corrective actions.
  - Ensuring the final report is provided in a timely manner to all appropriate parties.
  - Ensuring that the appropriate data is correctly and completely entered into the BNL IH exposure monitoring database (i.e. *Compliance Suite*<sup>®</sup>).
  - Ensuring that original records of sampling and analysis enter the SHSD *Record Custodian* filing system.
- 2.3 **Industrial Hygiene Technician (Sampler):** The industrial hygiene technician is to be qualified by their supervision to conduct industrial hygiene personal exposure monitoring under the direction of his/her organization's *IH Professional*. The sampler is responsible for collecting personal exposure monitoring samples in accordance with the guidance of the *IH Professional* and the requirements of all SOP's pertinent to the particular monitoring requirements (i.e. Chain of custody, equipment check in/out, equipment operation, recordkeeping, etc.).
- 2.4 **Compliance Suite<sup>®</sup> data entry:** The management of the person conducting the sampling is responsible for entering complete and correct data into the BNL IH exposure monitoring database (i.e. *Compliance Suite*) according to the procedure in IH60500. This task may be assigned to one or more individuals who act as the data entry person for an organization, however, it remains the responsibility of the line management of the *Sampler* to ensure this task is fulfilled within 10 business days of the end of the receipt of sampling data from the laboratory.
- 2.5 **Chain of Custody procedures:** The collector of the sample is responsible for the integrity of sample media and data sheets until it has been properly transferred to the SHSD IH Laboratory.

<p align="center"><b>BROOKHAVEN NATIONAL LABORATORY</b> Safety &amp; Health Services Division</p> <p align="center"><b>INDUSTRIAL HYGIENE GROUP</b> Standard Operating Procedure: Field Procedure</p>	<p>NUMBER <b>IH75140</b></p>
	<p>REVISION <b>FINAL Rev4</b></p>
<p align="center"><b>Atmospheric Testing with Integrated Sampling, i.e.</b> <b>Media &amp; Pump Sampling</b> (Active &amp; Passive Sampling with Sorbents / Filters / Impingers)</p>	<p>DATE <b>05/30/06</b></p>
	<p>PAGE <b>3</b> OF 14</p>

**2.6 Hazard Analysis of the Sampling Task:** It is the responsibility of the person using this method and his/her supervisor to ensure that the appropriate personal protective equipment is worn while performing this procedure. In addition, the person performing this procedure and his/her supervisor are responsible to ensure that all required training and qualification for hazards that may be present in areas where this procedure will be used (such as respiratory protection or radiation contamination) have been met. The person performing this procedure and his/her line supervisor are responsible to comply with all work planning and work permit system requirements.

### **3.0 Definitions**

- 3.1 ***Integrated Sampler:*** A sampling train including an analytical media and associated sampling device capable of collecting an airborne contaminant for subsequent analysis and quantifying of the concentration. Examples would be a carbon tube or MCEF filter used with a calibrated air sampling pump or a sorbent containing passive sampling badge.
- 3.2 ***Program Administrator:*** A person designated by the IH Group Leader or SHSD management to administer this procedure and the associated program of air sampling data management.
- 3.3 ***Qualified Surveyor:*** A person who has demonstrated competency, in accordance with Section 7, to perform this field procedure.

### **4.0 Prerequisites**

#### **4.1 Training prior to using this procedure:**

- 4.1.1 Demonstration of proper operation of the procedure per Section 7 for qualification requirements.
- 4.1.2 Other appropriate training for the area to be entered (check with ESH coordinator or FS Representative for the facility).

#### **4.2 Area Access:**

- 4.2.1 Contact the appropriate Facility Support Representative or Technician to obtain approval to enter radiological areas.
- 4.2.2 Verify with the appropriate Facility Support Representative or Technician if a Work Permit or Radiological Work Permit is needed or is in effect. If so,

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division  <b>INDUSTRIAL HYGIENE GROUP</b> Standard Operating Procedure: Field Procedure	NUMBER <b>IH75140</b>
	REVISION <b>FINAL Rev4</b>
<b>Atmospheric Testing with Integrated Sampling, i.e.</b> <b>Media &amp; Pump Sampling</b> <b>(Active &amp; Passive Sampling with Sorbents / Filters / Impingers)</b>	DATE <b>05/30/06</b>
	PAGE <b>4</b> OF 14

review and sign the permit.

4.2.3 Use appropriate PPE for area.

## **5.0 Precautions**

5.1 **Hazard assessment:** The actual task of taking an integrated sample typically does not cause significant employee health risks. (Note: some impinger solutions are hazardous.) But by its very nature, this SOP may be performed in areas with chemical or radiation contamination, and these hazards must be assessed on a case-by-case basis. No one is to perform sampling until a knowledgeable individual has assessed the hazards of the area.

5.2 **Personal Protective Equipment:** Appropriate personal protective equipment to protect the person collecting the sample must be used when implementing this procedure. Where the potential for contamination of the body can occur, the use of disposable clothing to cover the areas of contact is required.

5.2.1 **Hand:** Sample collection in areas of known or suspected chemical or radiological contamination requires the use of disposable gloves. Exam-style, splash gloves are acceptable. Acceptable elastomers are: Nitrile, PVC, and Natural Rubber.

5.2.2 **Body:** If contact of the body with contaminated surfaces is anticipated, a disposable suit should be used. Acceptable chemical protective equipment materials include: Tyvek®, KleenGuard®, and cotton. Disposable garments must be discarded as hazardous waste if contact with contamination has occurred. If personal clothing items become contaminated, they must be surrendered for BNL cleaning or disposal.

5.2.3 **Foot:** If contact of the feet is anticipated with contaminated surfaces, disposable shoe coverings, boots or booties should be used. Acceptable CPC material include: Tyvek®, KleenGuard®, and rubber. If personal shoes become contaminated, they must be surrendered for BNL cleaning or disposal.

5.2.4 **Respiratory:** Under normal use, respiratory protection is not required. If chemical or radiological levels from contamination in the area exceed or are likely to exceed the OSHA, ACGIH, or DOE standards, respirators are required. A half face or full face APR or PAPR respirator with appropriate cartridge or an air line respirator may be used up to the assigned protection factor listed in the BNL's Respiratory Protection Selection and Issuance SOPs.

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division  <b>INDUSTRIAL HYGIENE GROUP</b> Standard Operating Procedure: Field Procedure	NUMBER <b>IH75140</b>
	REVISION <b>FINAL Rev4</b>
<b>Atmospheric Testing with Integrated Sampling, i.e.</b> <b>Media &amp; Pump Sampling</b> <b>(Active &amp; Passive Sampling with Sorbents / Filters / Impingers)</b>	DATE <b>05/30/06</b>
	PAGE <b>5 OF 14</b>

5.2.5 **Eye:** Safety Glasses with side shields are required in laboratories, construction, and general industry areas. When hazardous chemicals can significantly injure the eyes, a full face respirator must be used.

5.3 **Radiation Contamination:** It is possible that some surfaces in areas to be tested may have radiation contamination. In these cases, personal protective equipment and administrative controls must be implemented for the radiation contaminant hazard in addition to the chemical hazard. In addition, the collected sample from these areas must be analyzed for the radiation hazard before it can be submitted to the SHSD IH Laboratory for analysis. At no time will the SHSD IH Laboratory accept a sample with radiation contamination above permissible limits for the general public.

5.4 **Work Planning:** All requirements of work permits and work planning system reviews must be met in performing this procedure.

5.5 **Environmental Impact and Waste Disposal:** This sampling does not have adverse impact on the environment or create waste for disposal.

5.6 **Job Risk Assessment:** Consult the *Job Risk Assessment* IHG-JRA-05 for the risk analysis of this operation based on the hazards and controls of this SOP.

## 6.0 Procedure

### 6.1 Equipment-

- 6.1.1 **Media-** adsorbent, absorbent, filter, or impinger solution.
- 6.1.2 **Pump:** active sampling- portable, battery or line voltage operated, sampling device worn on the employee's belt or a fixed location sampler.
- 6.1.3 **Passive Dosimeter:** an adsorbent containing device with a permeable membrane. The dosimeter is worn on the worker's lapel that samples passively by diffusion.



6.2 **Selection of Media:** Contact an IH Group professional or other competent individual for assistance in selecting the appropriate media, sampling equipment, sampling parameters (flow rate), precautions or special handling needs, and post sampling

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division  <b>INDUSTRIAL HYGIENE GROUP</b> Standard Operating Procedure: Field Procedure	NUMBER <b>IH75140</b>
	REVISION <b>FINAL Rev4</b>
<b>Atmospheric Testing with Integrated Sampling, i.e.</b> <b>Media &amp; Pump Sampling</b> (Active & Passive Sampling with Sorbents / Filters / Impingers)	DATE <b>05/30/06</b>
	PAGE <b>6 OF14</b>

storage requirements. Particulate media will be selected by the IH Lab based criteria listed in Attachment 9.3.

### 6.3 Sampling Technique Principles:

- 6.3.1 OEL compliance sampling for employee exposure monitoring is done with a portable sampler with sorbent/filter attached in the breathing zone (lapel) of the worker, whenever possible. Fixed sampling is only permitted when portable sampling cannot provide the needed analytical sensitivity or the sampling equipment would cause a safety risk.
- 6.3.2 Observe the sampling over the entire period, when possible. During lunch and break periods, if the workers leave the area of hazard, then pumps may be removed and shut off and placed back on the worker and restarted after the break. Record the stop and re-start time. The pump may be left on the worker during breaks if practical.
- 6.3.3 Carefully record the pump start and stop time to the nearest 1 minute. Use the sample watch (or synchronized) for the entire sampling period
- 6.3.4 Area samples may also provide useful information. Determining the NUMBER and LOCATION of samples varies case-by-case. Professional judgment is needed in determining the sampling parameters based on factors such as the size of the area to be tested, the predicted uniformity of contamination within the area, relative hazard of the contaminant, and the accuracy, precision (repeatability), & sensitivity of the analytical method and the time of sampling. It is appropriate to take samples in:
- areas where workers predominately spend time or frequently access,
  - at sources of the contamination (such as process equipment & lab apparatus),
  - areas where contamination is not expected (serves as a control), and
  - areas where contamination would not be permissible (such as lunch rooms and offices).

### 6.4 Preparation & Handling of Sampling Equipment

- 6.4.1 **Pre-calibration:** The IH Laboratory will pre-calibrate the sampling train using the field media or a representative media sample in line prior to field sampling.

<p align="center"><b>BROOKHAVEN NATIONAL LABORATORY</b> Safety &amp; Health Services Division</p> <p align="center"><b>INDUSTRIAL HYGIENE GROUP</b> Standard Operating Procedure: Field Procedure</p>	<p>NUMBER <b>IH75140</b></p>
	<p>REVISION <b>FINAL Rev4</b></p>
<p align="center"><b>Atmospheric Testing with Integrated Sampling, i.e.</b> <b>Media &amp; Pump Sampling</b> (Active &amp; Passive Sampling with Sorbents / Filters / Impingers)</p>	<p>DATE <b>05/30/06</b></p>
	<p>PAGE <b>7</b> OF 14</p>

6.4.2 **Post-calibration:** The IH Laboratory will post-calibrate the sampling train in accordance with IH75150 or IH75160 using the field media or a representative media sample in line after field sampling.

6.4.3 **Sample Storage:** The IH Laboratory will store exposed media in accordance with the NIOSH/OSHA method in the interim between return of the media from the field, post calibration, and shipment of the media to the analytical laboratory.

6.4.4 **Chain of Custody:** All provisions of IH51300 will be followed in processing samples for field use and shipment to the analytical laboratory.

6.4.5 **Laboratory Analysis:**

6.4.5.1 BNL may analyze lead filters at the IH Laboratory using a factory calibrated XRF meter as per the NIOSH/OSHA method.

6.4.5.2 BNL will ship samples to an AIHA PAT certified laboratory for quantitative analysis by Gas Chromatography, High Performance Liquid Chromatography, Atomic Absorption Analyzer, Inductively Coupled Plasma Spectroscopy, or other analytical technique described in a NIOSH or OSHA method.

6.5 **Recording readings:**

6.5.1 Plan and conduct hazard assessments and exposure monitoring using the procedure outlined in *IH 60500 Reporting Personnel Exposure Monitoring Results* for:

- Exposure Assessment Sampling Strategy,
- Initial Notification of Employee Monitoring Results, and
- Preparation of a formal report on the exposure monitoring or hazard assessment.

6.5.2 Use a BNL *Air Sampling Survey* Form to record important information on the sampling scenario (Attachment 9.2).

6.5.3 Return media, pump and original *Air Sampling Survey* form to the SHSD IH Laboratory.

6.5.4 The IH Group will maintain a copy of sampling results for at least 75 years.

6.6 **Results interpretation:**

6.6.1 A competent person from the organization taking the samples writes a hazard evaluation report that evaluates the survey data and summarizes the

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division  <b>INDUSTRIAL HYGIENE GROUP</b> Standard Operating Procedure: Field Procedure	NUMBER <b>IH75140</b>
	REVISION <b>FINAL Rev4</b>
<b>Atmospheric Testing with Integrated Sampling, i.e.</b> <b>Media &amp; Pump Sampling</b> <b>(Active &amp; Passive Sampling with Sorbents / Filters / Impingers)</b>	DATE <b>05/30/06</b>
	PAGE <b>8 OF14</b>

potential for occupational exposure and compliance with OSHA and ACGIH Occupational Exposure Limits.

- 6.6.2 Distribute the hazard evaluation report to the worker, supervisor, and ESH Coordinator.
- 6.6.3 Ensure that a copy of the hazard evaluation report is sent to the IH Laboratory and is included in the ESHQ Directorate Recordkeeping system *Compliance Suite*. After data entry, return hardcopy of all sampling documents to the IH Laboratory.
- 6.6.4 Ensure that a summary of the written hazard evaluation report is sent to the Occupational Medicine Clinic with the worker(s) BNL Life Number(s) noted.
- 6.6.5 The hazard evaluation report, an *Employee Notification Form* (Attachment 9.4 of *IH60500 Reporting Personnel Exposure Monitoring Results*), or an equivalent method must be used to inform all employees monitored or represented by the monitoring of the results of the air sampling and the implication to compliance with OELs. Reporting to employees must be within time limits established by regulatory drivers, as listed in Attachment 9.3 of *IH60500 Reporting Personnel Exposure Monitoring Results*.

## **7.0 Implementation and Training**

Prior to using this procedure, the user:

- 7.1 Demonstrates proper operation of this instrument to the satisfaction of line supervision. Completes other appropriate training for the area to be entered (check with ESH coordinator or FS representative for the facility). Completes OT&Q Training and a medical surveillance required for any PPE used on the job or for other hazards encountered in the work area.
- 7.2 Personnel in SHSD are to document their training using the Attachment 9.1 *Job Performance Measure Completion Certificate: Airborne Chemical Sampling & Measurement Qualification record*. Qualification on this procedure on at least a 3 year basis.

## **8.0 References**

- 8.1 NIOSH Manual of Analytical Methods

<p align="center"><b>BROOKHAVEN NATIONAL LABORATORY</b> Safety &amp; Health Services Division</p> <p align="center"><b>INDUSTRIAL HYGIENE GROUP</b> Standard Operating Procedure: Field Procedure</p>	<p>NUMBER <b>IH75140</b></p>
<p align="center"><b>Atmospheric Testing with Integrated Sampling, i.e.</b> <b>Media &amp; Pump Sampling</b> (Active &amp; Passive Sampling with Sorbents / Filters / Impingers)</p>	<p>REVISION <b>FINAL Rev4</b></p> <p>DATE <b>05/30/06</b></p> <p>PAGE <b>9</b> OF 14</p>

## 8.2 OSHA SLC Laboratory Methods

## 9.0 Attachments

9.1 Airborne Chemical Sampling & Measurement Qualification record

9.2 Air Sampling Survey form

9.3 Particulate Filter Selection Criteria

## 10.0 Documentation

Document Development and Revision Control Tracking		
Prepared By: (Signature and date on file) <b>R. Selvey 03/19/01</b> SHSD IH Group	Technical Reviewed By / Date: (Signature and date on file) <b>J. Peters 03/19/01</b> SHSD IH Group <b>R. Wilson 03/19/01</b> SHSD IH Group	Approved By / Date: (Signature and date on file) <b>R. Selvey 04/24/01</b> IH Group Leader
ESH Coordinator/ Date:  <i>none</i>	Work Coordinator/ Date:  <i>none</i>	SHSD Manager / Date  <i>none</i>
QA Representative / Date:  <i>none</i>	Training Coordinator / Date:  <i>none</i>	Filing Code:  <b>IH52.05</b>
Facility Support Rep. / Date:  <i>none</i>	Environ. Compliance Rep. / Date:  <i>none</i>	Effective Date:  <b>04/24/2001</b>
ISM Review - Hazard Categorization <input type="checkbox"/> High <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Low/Skill of the craft	Validation: <input type="checkbox"/> Formal Walkthrough <input checked="" type="checkbox"/> Desk Top Review <input type="checkbox"/> SME Review Name / Date:	IMPLEMENTATION: Training Completed: 8/2005 Procedure posted on Web: 05/30/06 Hard Copy files updated: 05/30/06

Revision Log		
03/29/05	(Signature and date on file) <b>R. Selvey 03/29/05</b>	Revised to include Section 7 Implementation and Training. Text added to Section 2, 4, 5, 6, and 7.

The only official copy is on-line at the SHSD IH Group website.  
Before using a printed copy, verify that it is current by checking the document issue date on the website.

<p align="center"><b>BROOKHAVEN NATIONAL LABORATORY</b> Safety &amp; Health Services Division</p> <p align="center"><b>INDUSTRIAL HYGIENE GROUP</b> Standard Operating Procedure: Field Procedure</p>	<p>NUMBER <b>IH75140</b></p>
	<p>REVISION <b>FINAL Rev4</b></p>
<p align="center"><b>Atmospheric Testing with Integrated Sampling, i.e.</b> <b>Media &amp; Pump Sampling</b> <b>(Active &amp; Passive Sampling with Sorbents / Filters / Impingers)</b></p>	<p>DATE <b>05/30/06</b></p>
	<p>PAGE <b>10</b> OF 14</p>

Purpose: <input type="checkbox"/> Temporary Change <input type="checkbox"/> Change in Scope <input type="checkbox"/> Periodic review <input checked="" type="checkbox"/> Clarify/enhance procedural controls  Changed resulting from: <input type="checkbox"/> Environmental impacts <input type="checkbox"/> Federal, State and/or Local requirements <input type="checkbox"/> Corrective/preventive actions to non-conformances <input checked="" type="checkbox"/> none of the above  Section/page and Description of change: Added clarifying test based on comments from qualification class given to IH staff. Minor changes to Section 6 to add policy of lunch time sampling and accuracy of time on and off.. Some typo corrections in Section 7. Asbestos and silica added to Attachment 9.3 and the OEL column removed to avoid being out of date with annual TLV revisions. JPM was changed in format to newer version. Sample form had sample number change to be compatible with Compliance Suite.		
<i>R. Selvey 08/24/05(signature/date on file)</i> SME Reviewer/Date:	Reviewer/Date:	Reviewer/Date:
Purpose: <input type="checkbox"/> Temporary Change <input type="checkbox"/> Change in Scope <input type="checkbox"/> Periodic review <input checked="" type="checkbox"/> Clarify/enhance procedural controls  Changed resulting from: <input type="checkbox"/> Environmental impacts <input type="checkbox"/> Federal, State and/or Local requirements <input type="checkbox"/> Corrective/preventive actions to non-conformances <input checked="" type="checkbox"/> none of the above  Section/page and Description of change: Minor typo and text changes based on training classes of 11/04/05 and 12/16/05. Section 2.1 and 2.2 combined. Section 4.1 changed for clarity. Section 6.4.1 added post calibration. Section 6.5.1 deleted. Added new 6.6.2 for distribution to worker, supervisor and ESH coordinator.		
<i>R. Selvey 05/26/06(signature/date on file)</i> SME Reviewer/Date:	Reviewer/Date:	Reviewer/Date:
Purpose: <input type="checkbox"/> Temporary Change <input type="checkbox"/> Change in Scope <input type="checkbox"/> Periodic review <input checked="" type="checkbox"/> Clarify/enhance procedural controls  Changed resulting from: <input type="checkbox"/> Environmental impacts <input type="checkbox"/> Federal, State and/or Local requirements <input type="checkbox"/> Corrective/preventive actions to non-conformances <input checked="" type="checkbox"/> none of the above  Section/page and Description of change: Attachment 9.4 was added to describe the sampling parameters of the 3M® Badge.		
<i>R. Selvey 05/30/06(signature/date on file)</i> SME Reviewer/Date:	Reviewer/Date:	Reviewer/Date:

## Airborne Chemical Sampling & Measurement using Media and Pumps

### Job Performance Measure (JPM) Qualification Certificate

Candidate's Name	BNL#	Date of Qualification
		Expires (3 years)

Topic	Criteria	Qualification Status
<b>Hazard Analysis</b>	Can show how to perform (or who to request to perform) the hazard analysis of the sampling area and potential exposure to the sampler.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Corrected <input type="checkbox"/> Not Qualified
<b>Personal Protective Equipment</b>	Understands the need to be aware of the potential surface contamination and airborne levels of contaminants and knows how to determine the need for PPE and how to obtain the correct PPE for the hazard.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Corrected <input type="checkbox"/> Not Qualified
<b>Sampling Equipment</b>	Shows where equipment needed for the procedure is located and how to properly sign it out.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Corrected <input type="checkbox"/> Not Qualified
<b>Sampling Protocol</b>	Understands the exposure monitoring logic necessary to appropriately select sampling locations to accurately measure worker, public and environmental exposure potential.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Corrected <input type="checkbox"/> Not Qualified
<b>Record forms</b>	Shows how to correctly and completely fill all forms associated with this SOP.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Corrected <input type="checkbox"/> Not Qualified
<b>Analysis of data</b>	Shows how to perform (or who to request to perform) the data analysis on the sampling data to access potential exposure to the sampler, worker, public and environment.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Corrected <input type="checkbox"/> Not Qualified

I accept the responsibility for performing this task as demonstrated within this JPM and the corresponding SOP.

Candidate Signature:	Date:
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I certify the candidate has satisfactorily performed each of the above listed steps and is capable of performing the task unsupervised.

Evaluator Signature:	Date:
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## IH75140 Attachment 9.3

### Particulate Sampling Parameters

Compound	Fraction	Sampler	Media	Flow (L/min)**
Asbestos	Total	Non-conductive Cassette, Open Faced	25 mm MCE	0.5 - 5
Arsenic	Total	Cassette	37mm MCE	1 – 3
	Total	Cassette	37mm MCE	1 – 3
Beryllium	Total- TWA8	Cassette	37mm MCE	1 – 4
	Total- STEL	Cassette	37mm MCE	1 – 4
	Total	Cassette	37mm MCE	2 – 2.5
	Total	Cassette	37mm MCE	1 – 4
Cadmium	Inhalable	IOM	25mm MCE	2.0
	Respirable	Cyclone	37mm MCE	2.5
	Fume	Cassette	37mm MCE	1 – 3
	Dust- Total	Cassette	37mm MCE	1 – 3
Chromium Metal	Total	Cassette	37mm MCE	1 – 3
	Total	Cassette	37mm MCE	1 – 3
Chromium III	Total	Cassette	37mm MCE	1 – 3
	Total	Cassette	37mm MCE	1 – 3
Chromium VI	Total	Cassette	37mm MCE	1 – 3
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Copper	Fume	Cassette	37mm MCE	1 – 3
	Dust	Cassette	37mm MCE	1 – 3
	Fume	Cassette	37mm MCE	1 – 3
	Dust	Cassette	37mm MCE	1 – 3
Dust, PNOC	Respirable	Cyclone	37mm PVC (1)	2.5
	Inhalable	IOM	25mm PVC (1)	2.0
	Respirable	Cyclone	37mm PVC (1)	2.5
	Total	Cassette	37mm PVC (1)	1.5 – 2
Fiberglass	Total	Cassette	25mm MCE	0.5 – 16
	Total	Cassette	37mm PVC	1 – 3
	Respirable	Cyclone	37mm PVC	2.5
	Total	Cassette	37mm PVC	1 – 3
Iron Oxide	Total	Cassette	37mm MCE	1 – 4
	Total	Cassette	37mm MCE	1 – 4
Lead	Total	Cassette	37mm MCE	1 – 4
	Total	Cassette	37mm MCE	1 – 4
Nickel	Inhalable	IOM	25mm MCE	2.0
	Total	Cassette	37mm MCE	1 – 4
Silica	Respirator	Cyclone	37mm PVC (1)	1.7 Nylon; 2.5 Aluminum
Welding Fumes	Total	Cassette	37mm PVC	1

#### Media abbreviations:

(1) All gravimetric analysis on matched weight filters or tared filter.  
 Except for Asbestos, and cyclones all cassettes are CLOSED faced.  
 37mm MCE = 37mm diameter Mixed Cellulose Ester Membrane, 0.8 micron pore size  
 25mm MCE = 25mm diameter Mixed Cellulose Ester Membrane, 0.8 micron pore size  
 37mm PVC = 37mm diameter Poly Vinyl Chloride Membrane, 5.0 micron pore size

Flow Rate and Media based on NIOSH Method unless noted below:

- IOM flow of 2.0 based on SKC, Inc. sampler specifications for 100 micron cutpoint)
- Cyclone flow of 2.5 based on SKC, Inc. sampler specifications for 4 micron cutpoint (ACGIH)
- Cyclone flow of 1.7 based on NIOSH method for 10 micron midpoint (OSHA)

# IH75140 Attachment 9.4

## 3M® Passive Vapor Badges Chemical Compound List

Acetone (2) (c) Acetonitrile (2) (c) Acrylonitrile (8) Allyl Alcohol (8) Amyl Acetate (8) n-Amyl Alcohol s-Amyl Alcohol Benzene (8) Benzyl Chloride (8) Bromoform (8) 1-Bromopropane (m) n-Butyl Acetate (8) s-Butyl Acetate (8) t-Butyl Acetate (8) Butyl Acrylate (8) n-Butyl Alcohol (8) s-Butyl Alcohol (8) t-Butyl Alcohol (8) Butyl Cellosolve Acetate Butyl Cellosolve (8) Butyl Glycidyl Ether (8) p-tert Butyl Toluene (8) Camphor (8) Carbon Tetrachloride (8) Cellosolve (8) Cellosolve Acetate (8) Chlorobenzene (8) Chloroform (8) o-Chlorostyrene (8) o-Chlorotoluene (8) Cumene (8) Cyclohexane (6) Cyclohexanol (8)	Cyclohexanone (8) Cyclohexene (8) n-Decane Diacetone Alcohol (8) o-Dichlorobenzene (8) p-Dichlorobenzene (8) trans-1,2-Dichloroethylene (6) Diisobutyl Ketone (DIBK) (8) p-Dioxane (8) Dipropylene Glycol Methyl Ether Acetate Enflurane (8) Epichlorohydrin (8) Ethoxy Perfluorobutane Ethyl Acetate (6) Ethyl Acrylate (8) Ethyl Benzene (8) Ethylene Chlorohydrin (8) Ethylene Dichloride (EDC) (8) Ethyl Ether (4) (c) Furfural (8) Halothane (8) n-Heptane (8) n-Hexane (8) iso-Amyl Acetate (8) iso-Butyl Alcohol (8) Isoflurane (Forane) Isopar G Isophorone (8) Isopropyl Acetate (7) Isopropyl Alcohol (m) (c) Mesitylene (8)	M Mesityl Oxide (8) Methoxy Perfluorobutane (HFE-7100) ethyl Acrylate (8) Methyl t-Butyl Ether (MTBE) (8) Methyl Butyl Ketone (MBK) (8) Methyl Cellosolve (8) Methyl Cellosolve Acetate (8) Methylene Chloride (m) (3530 only) Methyl Ethyl Ketone (MEK) (8) Methyl Isobutyl Ketone (MIBK) (8) Methyl Methacrylate (8) Methyl Propyl Ketone (8) Naptha (VM&P) (8) n-Octane (8) Perchloroethylene (8) Phenyl Ether (8) n-Propyl Acetate (8) n-Propyl Alcohol (6) Propylene Dichloride (8) Propylene Glycol Mono Methyl Ether (8) Propylene Glycol Mono Methyl Ether Acetate Stoddard Solvent (8) Styrene (8) 1,1,2,2-Tetrachloroethane (8) Tetrahydrofuran (8) Toluene (8) 1,1,1-Trichloroethane (Methyl Chloroform) (m) Trichloroethylene (8) 1,1,2-Trichloro-1,2,2-trifluoroethane (1) (c) Vinyl Acetate (8) Vinyl Toluene (8) Xylene (8) Total Hydrocarbons as n-Hexane †`
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The number in parenthesis is the recommended sampling period in hours. This time has been estimated using the capacity of the 3510 organic vapor monitor, a relative humidity of <50% and the 1998 ACGIH TLVs. Use of the 3530 allows the sampling time to increase.





(c) Because of their high vapor pressures (low boiling points), the (c) compounds are best sampled initially with the 3520 monitor (with back-up section). Subsequent sampling may be done with the 3500/3510 monitor if determined, by 3520 results, that contaminant concentrations are within the 3500/3510 capacity limits.

†NOTE: certain compounds (e.g. acetone, methyl ethyl ketone, vinyl acetate, etc.) may show a decreased recovery when sampled in high relative humidity. Refrigerate and/or expedite for analysis to help ensure accurate results.

(m) See technical bulletin.

Organic Vapor Monitors provide accurate results if they are used within their performance limitations and if the analytical laboratory conducting the analysis can accurately provide correct information. Some of the more common sampling errors are overloading the sorbent pad, sampling for contaminants that cannot be captured and retained by carbon, and the laboratory using incorrect recovery coefficients.

Sampling a full workshift is recommended in order to determine the workers' daily exposure level to organic contaminants. When monitoring some organic contaminants, sampling shorter than a full shift may be required in order to be within the recommended capacity of the organic vapor monitor. Under these circumstances, sequential sampling with several monitors can be performed to assess the 8 hour exposure.

			
3M 3500 Organic Vapor Passive Air Monitoring Badge	3M 3520 Organic Vapor w/Back-Up Section Passive Air Monitoring Badges	3M-3550 Ethylene Oxide Passive Monitoring Badge	3M-3720 Formaldehyde Passive Monitoring Badge (not acceptable for STEL monitoring).